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ABSTRACT

This case study revisited the admissions index (400 x high school grade point average plus total Scholastic Assessment Test (SAT) score) used by a private, Catholic, western university by measuring the correlations between high school GPA and SAT scores with the second term GPA to determine the weight of each variable in the index. Data came from 6 cohorts of recent freshmen, totaling 4,871 students. High school GPA turns out to be the best predictor for first-year academic achievement. The weight ratio of high school GPA and SAT is 1.65. Adding more weight to high school GPA is necessary to increase quality, chances of success, and selectivity. Further correlation analysis between second-term GPA and degree GPA presents a high correlation (r=0.811), which supports the use of second-term GPA for currently enrolled students to predict their academic success. However, different ethnic groups and gender groups also present different weights of predictors. It may change freshman class ethnic composition if ethnic and gender factors are not carefully considered in increasing the weight of high school GPA. (Author/SLD)

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Measuring the Weight of High School GPA and SAT Scores with Second Term GPA to Determine Admissions/Financial Aid Index – A Case Study

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Measuring the Weight of High School GPA and SAT Scores with Second Term GPA to Determine Admissions/Financial Aid Index – A Case Study

Abstract

This case study revisited the admissions index (400 x HS_GPA + SAT Total Score) by measuring the correlations between high school GPA and SAT scores with the second term GPA to determine the weight of each variable in the index. High School GPA turns out to be the best predictor for first-year academic achievement. The weight ratio of High School GPA and SAT is 1.65. Adding more weight to HS_GPA is necessary to increase quality, chances of success and selectivity. Further correlation analysis between second-term GPA and degree GPA presents a high correlation ($r = 0.811$), which convinces us to use second-term GPA for currently enrollment students to predict their academic success. However, different ethnic groups and gender groups also present different weights of predictors. It may change freshman ethnic compositions if ethnic and gender factors are not carefully considered in increasing the weight of High School GPA.

Measuring the Weight of High School GPA and SAT Scores with Second Term GPA to Determine Admissions/Financial Aid Index – A Case Study

Purpose of Study

The use of SAT scores as one of the major criteria in college admissions has become a more sensitive issue since the proposal of discontinuing SAT I scores in the University of California admissions standard by the President of the University of California about two years ago. The UC system will stop using SAT I scores in its admissions in Fall 2003. It is said that SAT I scores do not reflect the student's actual learning in high school, and students from economically disadvantaged families seldom benefit from such tests, as they normally cannot afford for those preparation courses conducted by the College Board and other agencies. The estimated cost is around $2,500 for each student per family. On the other hand, the College Board may have used the data selectively to make a judgment of quality of education, of which national average SAT I scores are often used as a reference to set admissions criteria, but SAT I scores are often a reflection of the higher-end achievers rather than the lower-end (Holland, 2000). Therefore, the argument is that a lot of lower-end students are left out for the equal opportunity of access when SAT I scores are used as a major measure for academic aptitude in college admissions. In the wave of scrutinizing the functions and effects of SAT I scores in the admissions criteria, a private, non-profit, western regional, Catholic University began to revisit its basic admissions/financial aid index to measure the weight of SAT I scores and high school GPA in relation to college GPA in order to rebalance the admission/financial aid criteria to fit our needs for quality and selectivity.

This West Regional University has been using SAT I scores and High School GPA widely with other measures such as social activities, essays, reference letters and interviews, etc in admission decisions, especially in the financial aid award packaging index. The University has given an equal weight to SAT I scores and high school GPA from 1995 to 2001. We felt it was the time to re-exanimate the weight and balance it to suit our students and institutional needs.

Studies Related to Admission Criteria

Past studies show that both high school GPA and SAT scores are the strongest predictors for institutional selectivity with the contributions of factors such as family income, parent's education, gender, etc. (Basten *et al* 1997). It is also suggested that race can be replaced by socioeconomic status in affirmative action policies to assist in diversifying student bodies. However, Keller et al's study (1994) indicated that although regressing adjusted college GPA on freshman SAT scores and high school GPA increased the SAT's predictive validity, it wouldn't increase freshman grades but did change freshman class ethnic and gender compositions in some majors. In addition, Rooney and Schaeffer (1998) reported that more than 275 colleges cross the U.S. had eliminated the policy of using SAT or ACT as a criterion in admissions decisions, which had increased both diversity and academic quality of their entering classes. Astin's IEO model (1991) depicts a close relationship between input, environment and outcomes. He emphasizes the importance of input since it relates to both environment and outcomes. Thus high school grades and standardized test scores are frequently found to be the best

input predictors in student retention studies. In addition, attribute and environmental variables such as gender, ethnicity age, ability and socioeconomic level are potential interaction variables continue to play roles in predicting outcomes (Astin, 1991). Noble and Sawyer (1997, in Mclaughlin & Brozovsky 1999) show that academic ability measured by standard tests such as ACT and high school grades have valid predictability in admissions criteria. Most studies show that there is a correlation between the input such as standard test scores and high school GPA with the outcomes such as college GPA. But our interest does not only focus on how much correlation between the input and outcomes, that is, academic abilities and academic achievement but also the different weights of SAT scores and high school GPA in relation to college GPA.

Research Method

This case study uses the most recent six freshman cohorts' data (from 1995 to 2000) to study the correlations and the weight of High School GPA (HS_GPA), SAT I scores (Verbal and Math) in relation to students' second term GPA. It is supposed that the second term GPA is one of the critical indicators of the student's academic success and determines the student's decision for retention. We chose the second term GPA as an important indicator because we normally loose about 13% students after the first year. The end of the second term is crucial for the University's students to make decision for retention. We did not choose the whole year's cumulative GPA in consideration that students might need time to adjust to a new learning environment in their first semester. Therefore, the first semester GPA is often unstable or unpredictable. To confirm this supposition, we conducted a correlation analysis between the second term GPA and degree GPA with historical freshmen cohorts from 1990 to 1995. Each historical cohort has at least a six-year graduation rate. It turns out that Second-term GPA and Degree GPA have a very high correlation ($r = 0.811$). Therefore, it is reasonable to use the second term GPA as an indicator to predict currently enrolled students' academic success in the University. We conducted an overall correlation analysis between Second Term GPA, high school GPA, SAT I scores (Verbal, Math and Total) and high school percentile. Then, we further conducted correlation analyses by gender, ethnicity and college so that data could be compared among different groups. The bilateral correlation method was used to measure correlations between all variables by gender, ethnicity and college. Mean, median and mode scores of each numerical variable are examined to identify differences of entering predispositions and ending achievement among different groups. We did not use other socioeconomic variables, as they are not available in our database. Moreover, we wanted to focus on studying admissions/financial aid index only, trying to limit any other distracting and unstable variables.

We looked at the University's original admission/financial aid index: "Index = 400 * HS_GPA + Total SAT I", which was visited in 1994, to find out the best constant for HS_GPA in relation to student achievement at this Western Regional University. In this equation, High School GPA and Total SAT scores have an equal weight, since 400 multiply High School GPA (4.0) equals to 1600 and the total SAT score (verbal and math) also equals to 1600. The constant of 400 was added from its original 200 in 1995, thus adding an equal weight to high school GPA than before. Now, the research question is whether High School GPA should be given more weight in consideration of the current debate over the validity of SAT scores for an equal access to college admissions.

We also conducted regression analysis with Second Term GPA as the dependent variable and SAT scores and high school GPA as independent variables in order to produce standardized coefficients to measure the weight of each independent variable. Finally, a further regression analysis with all independent variables determined the significant variables that affect the dependent variable of college second term GPA. Here are all the independent variables involved in the final regression analysis: SAT Verbal, SAT Math, SAT Total, Gender (dummy variable), Ethnicity (dummy variables), high school percentile, and colleges (dummy variables).

Data Analysis

The criteria to retrieve students are freshmen by cohort; no zero attempted credit hours; those who retained in their second term at the University; those with second-term GPA; and those who have SAT scores. In fact, about 98-99% of the University's students have submitted SAT scores in their admissions application. There are a total of 4,871 students in recent six freshman cohorts. Males are 41.4% and females are 58% (Table 1). The percentages match the actual enrollment as most of these cohorts were still enrolled when the study was conducted.

Table 1. Freshman Cohorts in Study

Cohort	Number of Student	
1995		535
1996		600
1997		858
1998		888
1999		884
2000		1,106
Total		**4,871**
Gender		
Male	2,018	**41.4%**
Female	2,853	**58.6%**

Ethnic data also reflect the actual enrollment of the University's undergraduate student body with African Americans 7%, Latino/Hispanics 20%, Asian Americans 15%, Caucasians 50%, American Indian 1% and Unknown 8%. Because the number of American Indian students is small (less than ten for each cohort) most of our discussions below will not involve this group of students. Data sorted by college show that College of business Administration has 23% of students, College of Communication and Fine Arts 23%, College of Liberal Arts 31%, and College of Science and Engineering 23%.

The data profile displays the average values of all the variables (Table 2) in study. These numbers reveal that the University is a fairly selective institution in admissions. The fact that the average Second Term GPA is lower than the average High School GPA also suggests that college studies are tougher than high school student since there is one University's standard rather than multiple standards of different high schools.

Table 2. Data Profile

		HS Percentile	SAT Verbal	SAT Math	SAT Total	HS GPA	2nd Term GPA
	Valid	3153	4871	4871	4871	4852	4871
	Missing	1718	0	0	0	19	0
Mean		75.1	548	559	1107	3.31	2.90
Median		79	550	560	1100	3.29	3.00
Mode		91	560	550	1070	4.00	3.00
Std. Dev.		19.08	78.48	76.39	131.25	0.362	0.686

A box plot of high school GPA by ethnicity indicates that Latino student have a higher Median GPA and mid-50 percentile than other ethnic groups (Chart 1). However another box plot of college second-term GPA by ethnicity show that Caucasian, Asian American and Unknown have the higher end of second term GPA (Chart 2). This, to some extent confirms our knowledge that Latino students' high school GPA is often inflated due to some reasons such as school locations and components.

Chart 1. High School GPA by Ethnicity

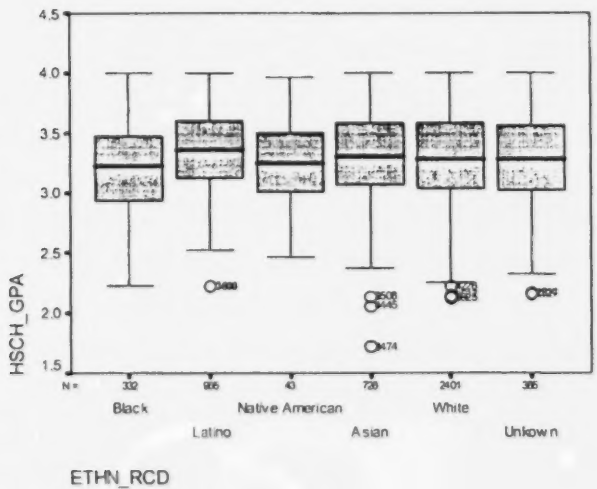
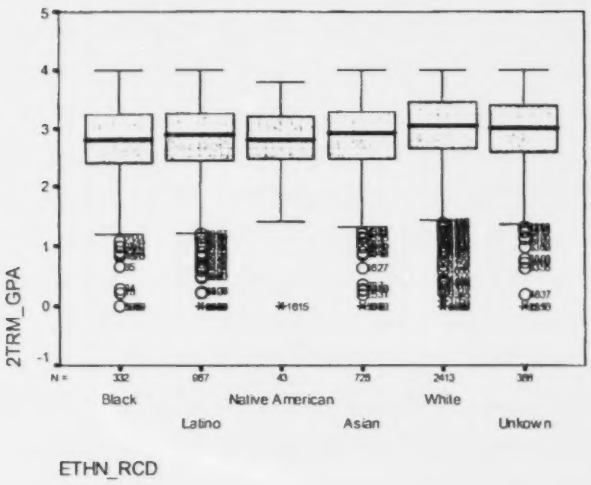
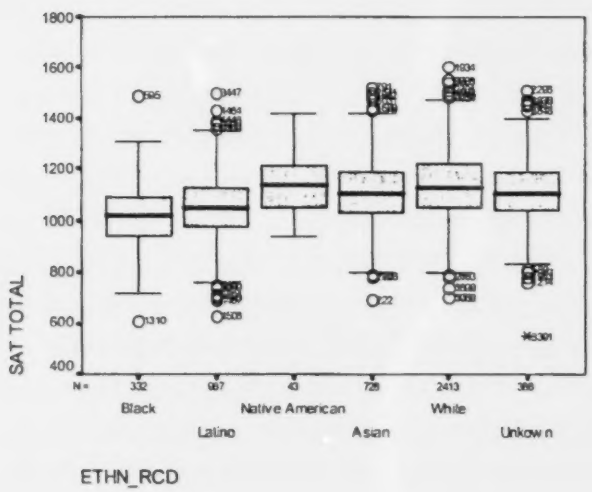


Chart 2. Second Term GPA by Ethnicity



The third box plot of SAT Total Score by ethnicity certainly indicates that Latino and African American students do not do as well as other ethnic groups (Chart 3). This responds, to some extend, to the debate that SAT I Tests do not help underrepresented ethnic groups.

Chart 3. SAT Total by Ethnicity



The overall correlation analysis shows that HS_GPA is the best predictor, which has the highest correlation (r = 0.386) with the Second Term GPA. SAT Total Score is the second best predictor (r = 0.265), which has a higher correlation with the Second Term GPA than any individual SAT Verbal and SAT Math scores. Correlation analysis by ethnicity shows that high school GPA is still the best predictor for certain groups such as Caucasian, Latino and Asian American groups. Caucasian students have the highest correlation, and Latino the second highest, and Black the lowest (Table 3).

However, it is interesting to note that SAT verbal is a better predictor of the second term GPA than HS_GPA for African American students. Asian Students have the highest correlation between SAT Total and the second term GPA. Correlations by gender show that HS_GPA is a much better predictor for Second Term GPA for males than females. Correlation analysis by college indicates that HS_GPA is a better predictor for College of Communication and Arts and College of Business Administration than other colleges. College of Liberal Arts has the lowest correlation between HS_GPA and the second-term GPA.

Table 3: Correlations between 2nd Term GPA and Other Variables

	H.S.Percentile	SAT Verbal	SAT Math	SAT Total	H.S. GPA	2nd Term GPA
Overall	.267**	.263**	.185**	.265**	.386**	1.000
Afr. Ame.	.084	.277**	.138**	.253**	.265**	1.000
Latino	.188**	.156**	.075*	.139**	.341**	1.000
Native Ame.	.174	.240	.128	.223	.307*	1.000
Asian Ame.	.290**	.256**	.189**	.264**	.448**	1.000
Caucasian	.373**	.251**	.201**	.268**	.441**	1.000
Unknown	.292**	.282**	.144**	.258**	.456**	1.000
Male	.288**	.240**	.196**	.256**	.410**	1.000
Female	.233**	.299**	.245**	.322**	.347**	1.000

** Correlation is significant at 0.01 level (2-tailed)
* Correlation is significant at 0.05 level (2-tailed)

The above correlation analyses provide an important message that high school GPA is a better predictor than SAT total score. Furthermore, SAT total score is a better predictor than any individual SAT Verbal or SAT Math score. For all ethnic groups, SAT verbal is better correlated with second term GPA than SAT Math. However, for College of Science and Engineering, Science SAT math is a better predictor than SAT Verbal (r = .305 vs. r = .264).

By now, we know that high school GPA is a better indicator than SAT Total and any other single variables. We still needed to confirm it by regression analysis. Table 4 shows the result of the regression of high school GPA and SAT Total on the dependent variable of Second-Term GPA. It turned out that High School GPA has a standardized coefficient of 0.351 and SAT Total has 0.208. The weight ratio of the two independent variables is 1.69. This means that high school GPA has a 69% higher weight than SAT Total in explaining its relationship with Second Term GPA.

Table 4. Regression Analysis of High School GPA, SAT Total on Second Term GPA.

Model	B	Std. Error	Standardized Coefficient	t	Sig.
Constant	-.497	.102		-4.869	.000
HS_GPA	.664	.025	.351	26.763	.000
SAT_Total	.001088	.000	.208	15.874	.000

Model R = 0.434
Model Adjusted R Square = 0.188

Knowing that high school GPA has a higher weight, we used a range of incremental constant values to create different values for the high school GPA combination score and for each student record. The possible constant values are listed below:

Original Index = SAT Total + 400*HS_GPA

Predicted Index 1 = SAT Total + 500*HS_GPA
Predicted Index 2 = SAT Total + 600*HS_GPA
Predicted Index 3 = SAT Total + 700*HS_GPA
Predicted Index 4 = SAT Total + 800*HS_GPA
Predicted Index 5 = SAT Total + 900*HS_GPA
Predicted Index 6 = SAT Total + 1000*HS_GPA

We ran the correlations between the Second-term GPA with the predicted indexes and each single variable. It turns out that correlation between the second term GPA and predicted indexes reaches the highest point at a certain constant value and begins to drop down when the value of the constant still increases (Table 5). This allows us to find the best index fit for our students. Moreover, the predicted indexes have much higher correlations than all individual variables. It implies that using the combined index is a better practice than using any single variable in admissions consideration.

Table 5. Overall Correlations between 2nd Term GPA and Combined Index/Single Variables

Current Index	Index 500	Index 600	Index 700	Index 800	Index 900	Index 1000
.431**	.436**	.437**	.437*	.435**	.434**	.432**
H.S. Percentile	**SAT Verbal**	**SAT Math**	**SAT Total**	**H.S. GPA**	**2nd Term GPA**	
.267**	.263**	.185**	.265**	.386**	1.000	

** Correlation is significant at 0.01 level (2-tailed)
* Correlation is significant at 0.05 level (2-tailed)

The correlation analysis between Second-term GPA and Predict Indexes by gender reveals that current index is more suitable for female but Index 600 and Index 700 is more suitable for males (Table 6). This means that the increase of the weight of High School GPA will have a better predictive power on male students' achievement in their first year studies.

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Table 6. Correlation between 2nd Term GPA and Predicted Indexes by Gender

	Current Index	**Index 500**	**Index 600**	**Index 700**	**Index 800**	**Index 900**	**Index 1000**	**2nd term GPA**
Overall	.431**	.436**	.437**	.437**	.435**	.434**	.432**	1.000
Female	.431**	.429**	.426**	.422**	.418**	.414**	.410**	1.000
Male	.442**	.449**	.451**	.451**	.451	.449**	.448	1.000

** Correlation is significant at 0.01 level (2-tailed)
* Correlation is significant at 0.05 level (2-tailed)

Correlation analysis by ethnicity presents that the higher index are more fit for Latino/Hispanic and Caucasian students, but the current index is fit for African American, Asian American and Native American students. This means that High School GPA is a bigger factor for Latino and Caucasian students while SAT scores may be a bigger factor for African American, Asian American and Native American students. Seems high school GPA does not play as much a role as it does to Latino and Caucasian students.

We also did a comparison between the top ten percent students (2nd-term GPA >=3.7) and the overall student body. It shows the change of Index from 400 to 600 does not make much difference to top ten percent students as the correlations for top ten percent students are lowered compared to the overall correlations. This implies that adding weight to high school GPA does not increase as much predictive power as for the overall student body, because the top ten percent students are good in almost every academic aspect (Table 7).

Table 7: Comparison of Correlations between Top Ten Percent students and Overall students.

	Current Index	Index 500	Index 600	Index 700	Index 800	Index 900	Index 1000	2nd Term GPA
Top 10%	.280**	.282**	.282**	.282**	.281**	.280**	.279**	1.000
Overall	.431**	.436**	.437**	.437**	.435**	.434**	.432**	1.000

** Correlation is significant at 0.01 level (2-tailed)
* Correlation is significant at 0.05 level (2-tailed)

The standard coefficients of HS_GPA and SAT Total Score generated by the regression analysis mentioned above reveals that the weight ratio of High School GPA and SAT total score is 1.65:1, which is much higher than that of the original Index 400 of 1.2:1. This suggests that we may need to increase the weight of high school GPA in order to increase predictive power of admissions/financial aid index for students' first year success. We used standardized coefficients to calculate the ratio between H.S. GPA and SAT Total with the average numbers filled in:

H.S. GPA and SAT Total Ratio = .351/.208 (standardized coefficients) = 1.69

The old Index 400 generates the ratio as:
1324 (HS_GPA 3.31*400)/1107 (SAT_Total) = 1.2

The predicted Index 550 generates the ratio as:

1821 (HS_GPA 3.31* 550)/1107 (SAT_Total) = 1.64

The predicted Index 600 generates the ratio as:
(1989 (HS_GPA 3.31*600)/1107 (SAT_Total) = 1.79

The above formulas tell that Index 600 is more suitable to this University's current situation as the University has become more selective in admissions in recent two years. To verify the validity of the regression analysis we used scatter plot of standardized residues, it shows a very clear and narrow line with small stand errors. We also use the coefficients to fill in the formula and generate a predicted 2nd Term GPA of 2.91 which is close to the actual 2nd Term GPA of 2.091:

Average SAT Total: 1106.92
Average HS_GPA: 3.31
Average 2nd Term GPA: 2.901

Regression Result:

$$Y = B_0 + B_1X_1 + B_2X_2$$

Predicted 2nd Term GPA = (-.497) + .001088*1106.92 + .664*3.31
= 2.905

Finally we did another regression with all available variables (categorical variables were dummy-coded). The results specify that High School GPA is still the largest predictor of the Second Term GPA, the next one is SAT scores (Table 8). Other significant factors affecting Second Term GPA are: Being a male has a negative effect on Second term GPA, and being a Latino or an Asian American also have a negative effect compared to Caucasians, although the weights are rather small. Being a student in the College of Science and Engineering has a larger negative effect on Second Term GPA, if we consider the difficulty of the subjects in the area.

Table 8: Regression on 2nd Term GPA with All Variables

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error			
(Constant)	-.438	.099		-4.403	.000
HS_GPA	.696	.024	.368	28.489	.000
SAT_Total	.001080	.000	.207	15.693	.000
Male	-.09464	.018	-.068	-5.20	.000
Latino	-.110	.022	-.074	-2.565	.010
Asian	-.06289	.025	-.033	-2.565	.010
Coll_SE	-.362	.024	-.22	-15.067	.000
Coll_BA	-.120	.024	-.074	-5.116	.000
Coll_CFA	.00845	.023	.054	3.778	.001

Model R = 0.516
Model Adjusted R Square = 0.263

Discussions

This study has demonstrated that high school GPA is a better predictor than the total SAT score for the University's students' first year academic achievement. However, SAT scores still have a sizable effect on predicting students' second-term GPA in the University's environment. Especially, SAT I scores still function as a predictor for some ethnic groups such as African American and Asian American students. Thus, THE UNIVERSITY is not going to entirely throw out SAT I scores in its admissions considerations at the present time until further analyses or evidence can prove the disadvantages of using SAT scores in admissions. Since high school GPA may have different effects on Second Term GPA for different ethnic and gender groups, a balanced weight increase of high school GPA in consideration all groups' needs and benefits is very important. THE UNIVERSITY has decided to go with Index 600 while giving further considerations to African American and Native Americans with other supplementary measures such as recommendations, social activities and interviews.

This study is not a study on student retention, but it mainly focuses on the relations between academic ability and academic achievement, deliberately neglecting other social and economic variables that may affect student academic achievement. It is partly because academic variables are the only quantitative variables available in our database, and partly because we tried to avoid interferences from other socioeconomic and environmental variables in order to have a better understanding of the relations of academic attributers/abilities to academic achievement that are mainly used in admissions and financial aid decisions. This will, of course, limit the use of the results of this study in student retention research, as other non-academic variables may have a greater effect on students' decision to stay or drop out. Further studies can be engaged to link academic abilities to student retention and attrition in terms of academic programs, support services, and financial aid, etc., but recently we found that the reasons of student leaving may not be an ability to pay issue, an academic achievement issue or an educational aspiration issue but, more often than not, an issue of "student-institution fit".

In comparing the weight of High School GPA and SAT score, one thing becomes clear that High School GPA is one of the major predispositions related to student academic ability. It becomes more reliable than SAT scores, as is debated that SAT I tests are more engaged to test what is learned beyond high school. GPA as a variable of academic ability is also consistent throughout university studies, as our correlation analysis between second-term GPA and degree GPA shows a very strong correlation ($r = 0.811$). Therefore, it is reasonable and possible to use second-term GPA in research to predict student future academic success when the degree data is not available for concurrently enrolled students.

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